Pakistan's rise to nuclear power and the contribution of German companies

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Pakistan's Rise to Nuclear Power and the Contribution of German Companies

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Summary

The amendment of the Foreign Trade and Payments Act (*Außenwirtschaftsgesetz*) has prompted the preparation of this paper because of concerns over potential setbacks in advances achieved over the past twenty years in regulating German exports to non-EU countries and shipments to member states of the EU and the watering down of export restrictions to correspond to the low standards in place at the EU level (with the objective of streamlining the Foreign Trade and Payments Act and nullifying special German requirements which place German exporters at a disadvantage compared with their European competitors, according to a spokesperson of the German Federal Ministry of Economics and Technology). This would send the wrong signal on combating proliferation. From the 1970s to 1990s the Federal Republic of Germany played an extremely negative role because it opened the doors wide to the proliferation of weapons of mass destruction through lax legislation and even more slipshod enforcement.

Alarmed by several scandals, in recent years the German government has taken the lead regarding this issue and it would be appropriate for it to continue to fulfill this role. The attitude of the German governments in the 1970s to 1990s as well as the attitude of the key government authorities responsible for controlling exports becomes clear through the example of the cases of illegal exports of nuclear technology to Pakistan. The cases at the beginning of this period show in particular how uninterested key staff members in government ministries and authorities were in following up leads from foreign intelligence agencies regarding companies and individuals in the Federal Republic of Germany. Until the early 1990s the legal situation was such that some acts of proliferation could not even be prosecuted because the licensing regime included only goods listed in Part 1 of the Export Control List (*Ausfuhrliste Teil I*). The relevant authorities – the Bundesamt für Wirtschaft (Federal Office of Economics, BAW) and customs authorities – were neither in terms of personnel nor due to the deficiency of their computer equipment – in a position to carry out their legally prescribed duties. The maximum sentence for even the most serious proliferation violations was three years in prison.

These circumstances made it possible that the export of entire production plants for the manufacture of uranium hexafluoride to Pakistan by Albrecht Migule (case 1) were only investigated after the US applied massive pressure and punished with a sentence of 8 months – suspended on probation. Other equally significant criminal proceedings ended in charges being dropped or in acquittals (case 2: the Heilingbrunner and Lerch trial).

All the criminal proceedings described above involve the illegal export of nuclear technology to Pakistan, mostly in the central area of manufacturing the nuclear fuel uranium-235. The Pakistani scientist Dr. Abdul Qadeer Khan plays a prominent role in this regard. A. Q. Khan, who completed part of his education as a metallurgist at the University of Technology in what was at the time West Berlin and was already able at that time to establish contacts with German citizens, acquired the necessary knowledge about the technology of uranium enrichment using gas ultracentrifuges during his work at the beginning of the 1970s for the trilateral organization URENCO at the Dutch uranium enrichment plant in Almelo. At the same time he acquired information about the various

German suppliers for Almelo. After his return to Pakistan in 1975, he carried out uranium enrichment with the support of the then premier, Zulfikar Ali Bhutto. When doing this he made use of the knowledge about uranium enrichment he had acquired in Almelo and the personal contacts he had established in Europe with suppliers of nuclear technology, from whom he obtained relevant exports. In this way, Khan made a decisive contribution to Pakistan's successful detonation of nuclear explosives in 1998, and Pakistan was thus the first Islamic state to possess the atomic bomb.

In the early 1990s, various scandals (among others events involving the Hanau firm Transnuklear, which led to criminal proceedings against Ortmayer and others – case 3 – as well as events involving the construction of a poison gas factory by the German "general contractor" Dr. Jürgen Hippenstiel-Imhausen in Rabta, Libya) led to a change in German export policy. There were decisive improvements to the authorization regulations and criminal law, appropriate financing and staffing of the authorization and customs agencies and intensive exchanges of information among the relevant authorities and their agencies. This had a positive impact on various criminal proceedings. Persons about whom there had been suspicions for decades that they could be playing a leading role in illegal exports to Pakistan, such as Heinz Mebus and his son-in-law Ernst Piffl (cases 4 and 5), could now be prosecuted. The change could be clearly seen in the criminal proceedings against the head of the firm V. just described, which could be opened not on the basis of foreign information but of a local investigation, and which ended in November 2005 with a prison sentence of seven years and three months and the cancellation of financial compensation in the amount of €150,000. What a difference from the criminal proceedings against Albrecht Migule!

The approach adopted at the beginning of the 1990s should continue to be pursued. Instead of making things easier for arms exports through the revision of the Foreign Trade and Payments Act, the German government ought to adopt measures to improve export controls at the national level even further.

This includes, for instance, post-shipment controls, in other words checking whether goods have reached the country to which they were being exported or whether those goods are still there. Such a check would be an effective means for detecting indirect deliveries and if necessary taking action. The personnel for this would already be available in part. The Federal Customs Administration makes use of customs liaison officers/customs attachés in numerous countries and these could take over this task. Included among these countries are the United Arab Emirates, a commonly used conduit for exporting goods to the final destination of Iran or Pakistan.

The number of foreign trade and payments audits would have to be drastically increased. In 1989 approximately 450 foreign trade and payment audits were carried out; the number increased during the 1990s to a maximum of 1,500 audits and then sank again to the present estimated 1,000 audits per year although there are tens of thousands of companies involved in foreign trade and payments.

For effective export controls in the future measures at the level of the EU are of critical importance. Here the German government should exert its influence in order to see to it

that cooperation among customs administrations in the area of export controls is decisively improved. The intensive cooperation that is common practice in for example narcotrafficking, contraband cigarette smuggling or brand piracy must be possible in the case of export controls too. In my opinion, the breakthrough to effective European export controls would be achieved through the creation of a European Anti-Proliferation Office – similar to the European Anti-Fraud Office (OLAF), which has already existed for years – which would collate the data on proliferation activities (companies and individuals) already available in the various European countries, process them and use them in investigations.

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1. Introduction

"German government intends to streamline weapons exports – weapons and tanks manufactured in Germany are high in demand. But until now such exports were subject to strict conditions. According to information obtained by *SPIEGEL*, that could now change." The current amendment of the Foreign Trade and Payments Act[1] being carried out was commented upon by *SPIEGEL-online* in this way on July 15, 2012. However, a spokeswoman for the Federal Ministry of Economics and Technology, which is responsible for the Foreign Trade and Payments Act, immediately explained to the news agency dapd that the amendment "specifically did not involve" the **export** of armaments. The goal was "to streamline the Foreign Trade and Payments Act" and "to repeal German special provisions which placed German exporters at a disadvantage with regard to their European competitors." The amendment allegedly only involves the **shipment** of armaments to other member states of the EU and will make this easier.[2] Whether this is really the case requires close examination.[3] Even the easing of restrictions on shipping of armaments is not without problems if it makes subsequent export easier.

The Federal Republic of Germany in particular should take care not to deviate from the course of tightening of export controls introduced at the beginning of the 1990s – after the Rabta scandal[4] – to instead revert to the status of a country in which export scandals were a regular occurrence.

This report covers that period and the period following it and, taking the example of Pakistan, shows how this country succeeded in becoming a nuclear power through illegal exports from Germany. Of particular importance in this is the Pakistani scientist Dr. Abdul Qadeer Khan, who on account of his work on the advanced enrichment of uranium is frequently referred to as the "father of the Pakistani atom bomb."[5] Germany's contribution primarily consists of the numerous unauthorized exports to Pakistan partly of complete plants, partly of individual components for the production of enriched uranium, the procurement of which can be largely attributed to Abdul Qadeer Khan's knowledge of nuclear technology companies in the Federal Republic of Germany, knowledge which

1 Draft legislation to modernize the Foreign Trade and Payments Act – BR-Drs. 519/12 of August 31, 2012.

2 "export" – shipment of goods to a third country (a country outside the EU); "shipment" – delivery of goods to a member state of the EU.

3 For example, § 5c AWV is to be struck from the legislation. However, § 5c also addressed the export of armaments. Nonetheless, this removal would have no consequences, since Art. 4 of the EU dual-use regulation covers such cases.

4 In Rabta, Libya the German industrialist Dr. Jürgen Hippenstiel-Imhausen, acting as "general contractor," built a factory for the production of poison gas.

5 From time to time there has been dispute about this title for A. Q. Khan: a study by the IISS, 2007, p. 15. Regarding the political decision, this title is said to be deserved far more by Zulfikar Ali Bhutto and by the Chairman of PAEC for many years, Munir Ahmad Khan, as far as the technical implementation of the decision is concerned.

Khan acquired during his time in the Netherlands. What must be taken into account is that the legal situation in the 1970s and 80s was favorable for such exports and because of their inadequate staffing and equipment and poor networking the government agencies were not in a position to detect such exports early enough and prevent them or even prosecute them. Since the 1990s, however, as a result of the changed legal situation and the improved capacities of the German agencies, to an increasing extent it has been possible to detect and block Pakistani procurement; where there had already been successful exports the German customs investigation service in particular successfully carried out criminal investigations which in many cases resulted in criminal convictions. These verdicts provide an important basis for the following section.

The example of Pakistan shows that through new investigative instruments and intensive cooperation at the national level it is possible to move from cases of initial failure to impressive success. Nonetheless, there are grounds for concern today about resting on one's laurels and underestimating the danger that is still posed by the spread of weapons of mass destruction. The number of cases detected is small and the media too, which once displayed strong interest in the topic of proliferation, hardly give this topic attention any more, let alone – as happened very often in the past – themselves exposing cases through investigative journalism. A new surge in interest is needed which should not just happen in response to a new scandal. It is no longer enough to be well prepared at the national level alone. The EU needs to take up this topic intensively by establishing an agency which collates and evaluates the knowledge already available – in part for a long time already – in the various member states, and uses this knowledge as the basis for taking specific measures against the wider spread of proliferation. The European Anti-Fraud Office (OLAF – *Office européen de lutte antifraude*) could be the model for a future "Anti-Proliferation Office".

2. The Technology of Uranium Enrichment and Pakistan's Acquisition of this Knowledge

After the initial deployment of atom bombs by the US in the Second World War other states sought – and are still seeking – to become nuclear powers too in order to either achieve a position of dominance in their region or to be able to stand up to an all-powerful neighboring state. India and Pakistan are among this group of countries.

2.1 The technology of uranium enrichment with gas ultracentrifuges

Two prerequisites are decisive for the manufacture of nuclear weapons: weapons-grade fissile material (plutonium or highly enriched uranium-235) and detonator technology. In the case of weapons-grade fissile material Pakistan has taken both paths. German exports mainly consisted of technology for production of highly-enriched uranium and from among the various manufacturing technologies, the technology for uranium enrichment using gas ultracentrifuges.

Enrichment of uranium-235 by means of gas ultracentrifuges is one of a number of possibilities for enriching uranium-235. Uranium-235 can also be enriched using the jet nozzle process, the gas diffusion process, electromagnetic isotope separation (EMIS) or laser enrichment;[6] today, enrichment with gas ultracentrifuges is the most economical method. Since the 1970s the gas ultracentrifuge process has been used industrially in the Federal Republic of Germany, the Netherlands and Great Britain by the URENCO consortium.

The basic principles of the gas ultracentrifuge process are well known and not classified; only its details are.

Uranium-235 is required for operating nuclear power stations and the production of nuclear warheads. The uranium-235 isotope – fissile through slow neutrons – only comprises about 0.7% of natural uranium; approximately 99.3% of natural uranium consists of the isotope uranium-238. To be used as fuel in nuclear power plants the proportion of isotope 235 must be enriched from 0.7% to 2.5 to 5% (low enriched uranium – LEU). At an enrichment level of 20% U-235 we speak of highly enriched uranium (HEU) which can be used for weapons production.

The purpose of all enrichment processes is the separation of uranium-235 from the heavy uranium-238 and the enrichment of the uranium-235.

Before the uranium-235 can be enriched to the desired level the following steps must be carried out:

- Mining of uranium ore. The key uranium mining countries are Australia, Canada and Niger. Pakistan also has uranium deposits.
- Extraction of the uranium from the ore.
- Chemical conversion of the uranium that has been extracted into uranium hexafluoride (UF_6) in so-called conversion plants.
- Transport of the uranium hexafluoride in standardized transport containers from the so-called conversion plants to the uranium enrichment plant.

At the uranium enrichment plants the actual process of uranium enrichment then takes place. At room temperature uranium hexafluoride is a white solid substance which only takes on the required gaseous state at a higher temperature. The transport container with the solid uranium hexafluoride is heated in a heating chamber – an autoclave. Under these conditions the uranium hexafluoride becomes gaseous, allowing it to be fed into the gas ultracentrifuges. Upon being fed into the rotor of the gas ultracentrifuge the uranium hexafluoride is swept along with the rotor which spins at extremely high speed. The heavy uranium-238 is separated from the lighter uranium-235 by the centrifugal force. At the upper end the uranium-238 depleted of uranium-235 is extracted through small stationary tubes called scoops – which end in a hook-shaped Pitot tube – while the uranium

6 Schaper/Frank 1998, Appendix B: A comparison of enrichment procedures.

hexafluoride enriched with uranium-235 is removed by scoops at the lower end of the centrifuge.

The degree of enrichment achieved with *one* gas ultracentrifuge is not sufficient to achieve the desired concentration of approximately 3% uranium-235. To achieve this, centrifuges – in practice 10,000 and more – must be linked in parallel and in series. The sequence of gas ultracentrifuges connected in parallel and series is called a cascade. Several cascades are operated alongside each other in a so-called separator building.

After the separation process in the cascades of gas ultracentrifuges the uranium-235 enriched and uranium-235 depleted streams are collected separately in deep frozen containers – so-called sublimators – and later conveyed to transport containers.

After this, transport to fuel element fabrication plants takes place. There, the uranium, now enriched to 3–5%, is converted into pellets. Fuel rods are filled with these pellets and are then used in nuclear power plants.

Highly enriched uranium-235, which is required for building nuclear weapons, is obtained by continuing the separation process longer.

2.2 The acquisition of the technology – further development

2.2.1 Abdul Qadeer Khan – origins and career up to 1975

A. Q. Khan was the central figure in Pakistan's efforts to become a nuclear power. Khan was born in 1936 in Bhopal in what was at that time British India. After the partition of British India into Pakistan and India in 1947 he emigrated to Pakistan in 1952. Khan studied mechanical engineering at the University of Karachi. After completing his studies he was initially an inspector at a bureau of standards. In 1961 he gave up this occupation and left Pakistan for further studies in Europe. Initially he studied at the Technical University in the then West Berlin and in 1963 went to Delft (Netherlands), where he studied metallurgy at the Technical University and in 1967 he received the masters degree of MSc (Physical Metallurgy) (Langewiesche 2005: 3ff). After four years in Delft he moved with his family to Leuven (Belgium). In 1972 he received his PhD (Physical Metallurgy) from the university in Leuven, Belgium for a study of the elasticity of metal alloys.[7] From May 1972 he worked for the Fysisch Dynamisch Onderzoekslaboratorium Technische Onderzoeken B.V. (FDO) in Amsterdam (Albright 2010: 15), itself part of Werkspoor Amsterdam, a partner of Ultra-Centrifuge Nederland N.V. (UCN) in Almelo, which in turn was the Dutch partner of the trilateral consortium URENCO Limited in Marlow near London (GB) (Sublette 2002: 1).

7 Interview with A. Q. Khan in the Pakistani Defence Journal, No. 12, 1990: 8ff; Langewiesche 2005: 5.

Khan required a security clearance for his work for FDO because, according to the Treaty of Almelo,[8] the technical details of the manufacture and operation of gas ultracentrifuges were officially classified. The documents and objects were classified with varying degrees of confidentiality.[9] On May 19, 1972 Khan signed a confidentiality agreement with FDO which among other things informed him about his duty of secrecy in connection with the gas ultracentrifuge project and drew attention to the consequences of a violation – even after leaving the company.[10] From the Dutch Ministry of Economics Khan received only authorization to deal with documents having a low level of classification involving the Dutch centrifuges only, not documents of the British and German partners to the treaty (Albright 2010: 18).

Within a short time of starting work with FDO, Khan had already visited the enrichment plant in Almelo. Khan was entrusted with the task of translating top secret technical documents which described the centrifuges in detail. He was often able to take these documents home with him (Albright 2010: 23). In his first two years of employment Khan worked with two older types of Dutch centrifuge – the CNOR and the SNOR; at the end of 1974 Khan translated highly classified documents concerned with the two more advanced German type G-1 and G-2 centrifuges (Sublette 2002: 2; Koppe/Koch 1990: 35f; *Der Spiegel* 1979: 46:202ff; Albright 2010: 18f; IISS Strategic Dossier 2007: 17).

2.2.2 Khan's return to Pakistan in December 1975

In December 1975 A. Q. Khan flew to Pakistan with his family – ostensibly to have a vacation – and has not returned. He advised his employer, FDO, that he was sick; later he declared that he had found new employment so that regrettably he had to resign (Langewiesche 2005: 10f). His return is said to have been preceded by a letter on September 1974 from Khan to the then Prime Minister of Pakistan, in which Khan is supposed to have offered his services (Sublette 2002: 2). Bhutto is said to have answered via the Pakistan Embassy in The Hague, and the two are supposed to have met in Karachi in December 1974 – during a vacation. A. Q. Khan is said to have convinced Bhutto not to rely only on plutonium for building an atomic bomb (see below), but to take the faster route by means of the high-level enrichment of uranium, especially since at that time Pakistan – on May 18, 1974 India had conducted its first nuclear test – had learned that Canada had ceased its support for the first Pakistani nuclear power plant KANUPP I (Karachi Nuclear Power Plant), built in the vicinity of Karachi, and that because of US protests France was no longer willing to complete the contractually agreed upon and partially completed construction of a reprocessing plant whose operation would yield plutonium (Koppe/Koch

8 Treaty of March 4, 1970 between the Federal Republic of Germany, the Kingdom of the Netherlands and the United Kingdom of Great Britain and Northern Ireland on cooperation in the development and use of the gas ultracentrifuges process for the production of enriched uranium – BGBl. 1971, part II: 930ff.

9 Treaty, Appendix II – Security procedure and confidentiality –BGBl. II, 930ff (946ff).

10 Verdict on appeal of the State Court of Amsterdam of November 14, 1983.

1990: 43). Bhutto is supposed to have regarded it as advantageous to pursue the path of both plutonium production and a high-enrichment program for uranium, and is said to have given A. Q. Khan the task of enriching uranium (Langewiesche 2005: 8). Khan returned to Amsterdam and at the latest from that point in time he may well have smuggled out the uranium enrichment process designs from Almelo.

2.2.3 Pakistan's development of nuclear technology until 1975

Pakistan's nuclear armaments program was already in full swing at the time of Khan's return in December 1975. This progression to the status of a nuclear power had begun in the mid-1950s when Pakistan signed a treaty with the US on the peaceful use of nuclear power in 1953. On December 8, 1953 then US President Dwight D. Eisenhower made a speech in the UN General Assembly – "Atoms for Peace" – in which he called upon the member states to make peaceful use of atomic energy and at the same time suggested the formation of an international Agency for Atomic Energy – what later became the International Atomic Energy Agency (IAEA) – which should on the one hand promote the peaceful use of nuclear energy and on the other hand should ensure that nuclear energy could not be used for military purposes.

In March 1956 the Pakistani Prime Minister Huseyn Suhravadrie founded the Pakistan Atomic Energy Commission (PAEC) with the title "Atomic Energy Research Council" in Islamabad.[11]

In 1960 Zulfikar Ali Bhutto was serving as Minister of Mineral and Natural Resources in Ayub Khan's cabinet, and Dr. Ishrat H Usmani was director of the PAEC. One of Usmani's most important decisions was to send overseas for training approximately 600 Pakistanis, of whom ultimately about 100 returned to Pakistan with a doctoral degree (Sublette 2002: 3). 3). The Federal Republic of Germany also contributed to a considerable degree to the training of Pakistani scientists in the nuclear research centers in Karlsruhe and Jülich:[12] Here especially Dr. Nyamat Ali Javed must be mentioned. He was at the Nuclear Research Center Karlsruhe (KfK) for training in 1974 and in later years became fuel

11 www.paec.gov.pk/paec-hist.htm.

12 The cooperation between Pakistan and the Federal Republic of Germany is based on the "Treaty between the Government of the Federal Republic of Germany and the Government of the Islamic Republic of Pakistan concerning cooperation in scientific research and technical development", which was signed on November 30, 1972 in Islamabad and came into effect on October 15, 1973 – BGBl. 1974 II, 68ff. In the area of nuclear technology cooperation was spelled out in more detail: "An agreement on cooperation in the area of peaceful use of nuclear energy was entered into on June 25, 1974 between the Gesellschaft für Kernforschung mbH (GfK) – which later became the Kernforschungszentrum Karlsruhe (KfK) – and the Pakistan Atomic Energy Commission (PAEC) [...]. According to this, cooperation was to cover the entire spectrum of peaceful use of nuclear energy, **including the policy areas of uranium enrichment, reprocessing, and heavy-water production which are sensitive in terms of nonproliferation**." – BT-Drs. 11/7800 – Decision recommendation and report of the second investigative committee – 235 left column (printed boldface by the author); see also BT-Drs. 11/644 of July 27, 1987: 3f and BT-Drs. 11/7800: 236 left column; Koppe/Koch 1990: 37ff report many visits by German nuclear physicists in Pakistan.

cycle director at the PAEC (Koppe/Koch 1990: 111). Dr. Javed was – together with Sulfikar Ahmed Butt – one of the two persons with whom Rudolf Ortmayer of the NTG company established contacts (see below).

Also in 1960 the US provided Pakistan with $350,000 in development aid for the construction of its first research reactor – a 5MW light water reactor operated with highly enriched uranium known as PARR-1 (Pakistan Atomic Research Reactor) – which commenced operations in 1965 in the Pakistan Institute for Nuclear Sciences and Technology (PINSTECH) in Nilore.[13]

In 1960 President Ayub Khan named as his advisor for scientific matters Dr. Abdus Salam, who represented Pakistan as the leader of its delegation to the IAEA. In 1965 Dr. Salam travelled to the US where Pakistan and Canada signed a contract with General Electric Canada for the construction of the first nuclear power station in Karachi (Karachi Nuclear Power Plant – KANUPP I[14]). Construction commenced in 1966 and was completed in 1971.[15]

After the Third India-Pakistan War/the Bangladesh Liberation War in 1971, which ended with a devastating defeat for Pakistan, Bhutto, winner of the election in (West) Pakistan, became Prime Minister and was thus able to realize his long cherished plans to arm Pakistan with nuclear weapons.

January 24, 1972 is regarded as the birth date for Pakistan's nuclear weapons program. Bhutto is said to have had a strictly confidential meeting with about 70 leading scientists in Multan on that day. Bhutto demanded that they develop nuclear weapons, placed the PAEC directly under the authority of his office and named Munir Ahmad Khan, who had worked as head of the IAEA Reactor Engineering Division in Vienna, as head of the PAEC (Corera 2006: 9f).

Decisive for a nuclear weapons program is the ability to produce weapons-grade fissile material. Plutonium or highly enriched uranium-235 comes into question as weapons-grade fissile material. Pakistan initially chose to produce plutonium for its nuclear weapons. For with the heavy water reactor KANUPP I Pakistan was in a position to produce its own heavy water. However, Pakistan needed a reprocessing plant to recover plutonium from spent fuel rods. As a result, at the beginning of the 1970s a research reprocessing plant with the name "New Labs" was constructed in the Pakistan Institute for Nuclear Sciences and Technology by the Belgonucleaire company and the French firm Saint-Gobain Techniques Nouvelles (SGN). In March 1973 a contract was signed with SGN for the construction of a large-scale reprocessing plant with a capacity of more than 100 tons of fuel per year. The CHASMA plant would have had a capacity of 200 kg of weapons-

13 BT-Drs. 11/7800: 237 right column.

14 Power reactor from the heavy-water/natural uranium line of the Canadian CANDU type – BT-Drs. 11/7800: 237 right column.

15 BT-Drs. 11/7800: 237.

grade plutonium per year (Weissman/Krosney 1981: 66). However, the realization of the CHASMA project was blocked by US protests. In June 1978 France officially declared that the contract with Pakistan for the construction of the reprocessing plant had been cancelled.[16]

2.2.4 Development and construction of the uranium enrichment plant in Kahuta

When A. Q. Khan returned to Pakistan permanently in December 1975 he initially worked for the PAEC. A small pilot plant for uranium enrichment with gas ultracentrifuges headed by Sultan Bashiruddin Mahmood had been set up in Sihala – a few kilometers southeast of Islamabad. Khan initially worked under Mahmood as his director of research and development (Corera 2006: 17). But there were soon quarrels between him and the head of the PAEC, Munir Ahmad Khan. A. Q. Khan complained to Bhutto about Munir Ahmad Khan and the limited progress being made by the PAEC. Bhutto took no action against Munir Ahmad Khan, but he decided that A. Q. Khan would work independently of the PAEC and report directly to him and also guaranteed him a substantial budget (Langewiesche 2005: 14f). On July 31, 1976 A. Q. Khan founded the Engineering Research Laboratories (ERL) in the immediate vicinity of Kahuta, and built a uranium centrifuge plant based on the URENCO plants (Khan 1990: 18). Due to the clandestine procurements then taking place in Europe, the project made rapid progress. The export controls which were completely inadequate both in legal terms and also in practice (see below) in the 1970s and 1980s made procuring the required components easy for A. Q. Khan.

According to Khan, uranium was enriched for the first time on April 4, 1978. The plant was completed in 1979 and as of 1981 was producing enriched uranium in quantities worth mentioning. In recognition of Khan's services the then President, Zia Ul Haq, renamed the plant Khan Research Laboratories (KRL) in the same year (Sublette 2002: 3).

3. Export of Goods for Uranium Enrichment from Germany

As a consequence of the knowledge he had acquired at Urenco Nederland about the suppliers of components for the uranium enrichment in Almelo, and especially its core element – the gas ultracentrifuge – A. Q. Khan was able to approach the companies specifically. In doing this he made use of the friends in the Netherlands, Switzerland, Great Britain and Germany whom he made during his time as a student in Germany and the Netherlands and during his other stays in Europe: Henk Slebos, Friedrich Tinner, Peter Griffin, Günes Cirek and Heinz Mebus. Since procuring of materials from Germany is the central issue here, reference will be made only in passing to Henk Slebos and the

16 See Weissman/Krosney 1981 about further details: 206-208. SGN allegedly tried to continue to conduct the business via the Italian company Alcom.

other persons mentioned. The presentation of events is based on above all verdicts in German criminal courts from 1985 to 2008.

Two things should be kept in mind in evaluating the cases presented.

The legal and factual situation has changed in the course of these years, partly substantially for the better. Initially, the authorization legislation had substantial gaps, which could only be filled gradually. Because of their completely inadequate provision with personnel and equipment and poor exchange of information, the German government agencies responsible for export controls were completely unable to carry out their duties effectively. In addition, the political will to act decisively against proliferation was lacking. Events surrounding the construction of a poison gas factory in Rabta, Libya, led to a change in German export control policy and practice. The law on authorization was decisively improved initially at national level through the so-called catch all clauses of §§ 5aff AWV, later through the EU dual use regulation, and penalties were repeatedly made more severe. Export control agencies were substantially better equipped with staff and resources and the flow of information among departments and the agencies belonging to them optimized.[17]

The sentences of Migule and Dr. Heiligbrunner/Lerch are examples of the situation of export controls before the change in German export control; the other sentences are examples of the situation afterwards.

The sentences only involve a fraction of the procurement transactions which actually took place for they had to leave out of account actions that had exceeded the statute of limitations and could only punish actions which could be proved beyond reasonable doubt.

In following sections not all prosecutions involving the provision of nuclear armaments to Pakistan by German companies will be presented; a selection shows equally well on the one hand the extent to which German companies participated in the nuclear arming of Pakistan, and on the other, however, also how – distributed over the years – the legal and actual situation as well as the attitude of German agencies changed for the better from the point of view of fighting proliferation.

3.1 Criminal proceedings against Albrecht Migule[18]

At the very beginning comes the – in my opinion – most significant case of unauthorized export of goods to Pakistan: the delivery of a complete factory for the production of uranium hexafluoride (UF_6), which is (highly) enriched with uranium-235 during the enrichment process. The presentation of the case is based for the most part on the findings in the verdict of the Freiburg Municipal Court on March 11, 1985.

17 The situation before and after Rabta, Libya is described in detail by Müller 1989 and Müller/Dembinski/Kelle/Schaper 1994.

18 Verdict of the Freiburg Municipal Court on May 11, 1985 – 41 Ls 103/82.

In 1976 and 1977 the Freiburg businessman Albrecht Migule, in his capacity as managing director of the firm CES (Chemical Engineering Services) Kalthof GmbH, signed with the firm Arshad, Amjad and Arbid Ltd., Karachi, Pakistan – referred to as Triple A – three contracts for the delivery of the following plants:

On November 13, 1976 a contract for the delivery of a production plant for the manufacture of hydrofluoric acid (HF) and fluorine gas (F_2) was signed, in which the scope of performance of the supplier agreed upon in the contract encompassed the complete planning and related engineering work all the way through to commencement of production. The total purchase price amounted to DM 5,445,625.

On January 3, 1977 a contract for the delivery of a uranium hexafluoride (UF_6) plant with a capacity of 198 t per year and a uranium tetrafluoride (UF_4) plant with a capacity of 177 t per year, for which a price of in total DM 3,753,554 was agreed upon.

On May 9, 1977 the delivery of a uranium dioxide (UO_2) plant with a capacity of 16 t per year at a price of DM 5,900,000 was signed.

These plants taken together form a production unit for the manufacture of uranium hexafluoride, the only application of which is the production of enriched uranium, i.e. fissile material.

"One of Migule's negotiating partners was Dr. Nyamat Ali Javed, who in 1974, together with Abdul Majid had been trained in hot cell technology at the KfK in Karlsruhe and in the meantime had progressed to the position of director of the PAEC. Also involved in closing the contract were Mr Farooq and Mr Yousi of AAA.," according to Koppe/Koch in their description of the case (Koppe/Koch 1990: 61; see also Barth 1981: 28, 96-99).

The verdict of the Freiburg Municipal Court does not contain any details of how these contracts came into existence; it also does not mention the name of A. Q. Khan. The contact was probably made through the engineer Heinz Mebus, a friend of Khan's from their student days at the TU in Berlin. On April 23, 1977 CES Kalthof signed a contract with Mebus which involved his taking part in the projects; later additions extended his duties to include heading up the project (Koch 1988: 229; Koppe/Koch 1990: 57ff; Barth 1981, 28: 96-99). Migule had met Mebus at the Gattys company in Neu Isenburg before the two set up on their own (Koppe/Koch 1990: 61).

On Migule's instructions, the machines, materials and various pieces of equipment required to construct the plant were delivered between May 1977 and April 1980 in 62 shipments from the Federal Republic of Germany to Pakistan, where the plant was constructed under the supervision of the CES Kalthof company at an immediately neighboring complex. Migule and Mebus as well as engineers of CES Kalthof were repeatedly present in Pakistan (Koppe/Koch 1990: 58-62). The deliveries were declared as "machines

and equipment for a chemical factory".[19] The customs office responsible cleared the goods without any objections because their true significance was not recognized. The customs administration even placed a storage shed at Migule's disposal so that the company did not have to store the goods in Welchental.

Export licenses were not applied for at the appropriate licensing authority – the then Federal Office for Commercial Economics (BAW) – even though the requirement for a license was known to Migule.

On March 13, 1985 Albrecht Migule was sentenced by the Freiburg Municipal Court to eight months imprisonment for violations of § 34 (1) 3 of the Foreign Trade and Payments Act – suspended on probation – an extremely mild punishment in view of the significance of his offense. However, at that time the maximum legal penalty was only three years in prison. Today the maximum punishment in normal cases is five years and – in especially serious cases – fifteen years imprisonment. As a surety for his probation he had to pay the sum of DM 30,000. Heinz Mebus – for some inexplicable reason – got off scot free.

The export of the plant for producing uranium hexafluoride meant that the conditions for highly enriching uranium 235 in a uranium enrichment plant had been achieved, one of the most important prerequisites for building atom bombs.

How did it come to the criminal proceedings against Albrecht Migule? Not only the lenient punishment but also the events leading up to the criminal proceedings are typical for the way the Federal Government/German governments handled proliferation offences at that time:

In spring 1979 in the vicinity of a uranium ore mining operation in the Dera Ghazi Khan region the CIA came across representatives of two German companies who were working in plants for processing the uranium ore. The US government informed the West German Government about what they had discovered, but did not disclose any company names (Koppe/Koch 1990: 57, 59). This took place through a so-called non-paper of the US government on June 16, 1980.

The British government also sent the West German government a non-paper with the same contents on July 14, 1980 and called on the West German Government to investigate immediately (Koppe/Koch 1990: 59). Despite the detailed information in both communications from the US and Great Britain, the Federal Ministry of Economics and Technology, saw no reason to examine the matter closely, for "a check by the firm Kalthof which has been named has been determined by the BAW not to be known to the office, neither through lodging export license applications nor through any correspondence."[20]

19 Kleine-Brockhoff, in; Die Zeit of June 1, 1984; Kleine-Brockhoff, in: Die Zeit of March 15, 1985; Kleine-Brockhoff, in: Stuttgarter Zeitung of December28, 1988.

20 According to the written comment of the official in charge in the Office for Foreign Trade and Payments of the BMWi reproduced by Koppe/Koch 1990 on p. 59.

As though there would not have been sufficient possibilities for identifying the two companies unequivocally and without any great effort. Not until October 1980, after the British had provided additional information about the two companies did the BMWi, through its agency, the BAW, rouse itself to call for an audit of foreign trade and payments of CES Kalthof by the Freiburg Regional Tax Office. The results became available in February 1981. The Regional Tax Office initially initiated proceedings for a fine against Albrecht Migule, as they did not attach any great importance to the matter (Koppe/Koch 1990: 60, 63). Only after the press reported on the matter in summer 1981 (*Stern* 1981, 28: 96-98), did the Freiburg Regional Tax Office brief the Freiburg District Attorney's Office, which then commenced a criminal investigation through the then Freiburg Customs Investigation Office.[21]

3.2 Criminal proceedings against Dr. Otto Heilingbrunner and Gotthard Lerch

The procurement of in particular autoclaves and desublimators for uranium enrichment plants by Dr. Heilingbrunner and Gotthard Lerch has been described in detail by Koppe/Koch (1990: 72-105). That is why only a brief summary of events will be given here.

Dr. Heilingbrunner and Lerch were managers in the firm Leybold-Heraeus. The Leybold-Heraeus company – known today as Leybold AG – was and still is a leader in the manufacture of pumps. Special pumps are required in uranium enrichment plants. Leybold-Heraeus supplied the pumps for the uranium enrichment plant in Almelo, and Lerch was in charge of supplying them. He made the acquaintance of A. Q. Khan in this capacity.

Working for the Pakistanis, Dr. Heilingbrunner and Lerch approached the Buchs metal fabrication plant in Switzerland. According to URENCO documents, they had among other things autoclaves and desublimators built there and exported these to Pakistan via France. Uranium hexafluoride, which is a solid at room temperature, is heated in autoclaves so that it becomes gaseous and can be fed into gas ultracentrifuges; desublimators are containers at both ends of the gas ultracentrifuge cascades in which the uranium-235 enriched and depleted uranium hexafluoride are collected and cooled. When this became known to the German authorities, the departments responsible decided in September 1986 to open criminal proceedings for violation of the Foreign Trade and Payments Act and to request help from the Swiss government agencies. However, several more months passed before it was decided in a further departmental meeting in April 1987 that "the BMF […] will formally direct the Customs Criminal Service to obtain through the Cologne District Attorney's Office a search and seizure warrant against Leybold Heraeus from the responsible judge, at the latest on April 21, 1987 (Koppe/Koch 1990: 101). This decision was preceded by a conversation between the journalist Egmont R. Koch and the

21 Information given by the district attorney responsible at that time during a phone conversation with the author on October 26, 2011.

Customs Investigations Office in Cologne at the beginning of February 1987 in which Koch had informed the customs investigators about what he knew. In addition, the representatives of the responsible departments knew that a report by Koch was to be expected in *Stern* magazine on April 28, 1987 ("Stern" 1981, 28: 96-99). On April 27, 1987, under the leadership of the Cologne District Attorney, Leybold-Heraeus in Cologne and Hanau as well as the private apartment of Dr. Heilingbrunner were searched (Koch 1988: 250f). Dr. Heilingbrunner and Lerch were prosecuted by the Cologne District Attorney for violations of the Act against Unfair Competition (UWG). An indictment on a charge of violations of the Foreign Trade and Payments Act was not possible because Switzerland refused to provide judicial assistance. The Cologne District Court acquitted both defendants on April 30, 1992, because it could not be proved with the required degree of certainty that they had transported to Switzerland documents for the manufacture of parts for uranium enrichment plants without authorization and to their own advantage.[22]

The Swiss nationals had already been sentenced to fines of 4,000 Swiss francs by the Werdenberg District Court (*Bezirksgericht*) in the summer of 1987.[23]

Almost twenty years after the first trial before the Cologne Municipal Court, Lerch was once again on trial before a German court; the Stuttgart Higher Regional Court sentenced him to five years in prison.[24] However, this second trial had nothing to do with the issue of how Pakistan succeeded in becoming a nuclear power, but instead involved the proliferation network of A. Q. Khan, of which Gotthard Lerch was a part.

3.3 Criminal proceedings against Rudolf Ortmayer and others

The criminal proceedings against Rudolf Ortmayer, Peter Finke and Dr. Heinrich Weichselgartner, of Neue Technologien GmbH & Co KG (NTG) in Gelnhausen for unauthorized export of plants and materials for the manufacture of fuel rods to Pakistan and offences against the War Weapons Control Act were conducted by the Hanau District Attorney in connection with events surrounding the Hanau nuclear company NUKEM GmbH, Reaktor Brennelemente GmbH, Hochtemperaturreaktor-Brennelement GmbH, ALKEM GmbH, Transnuklear GmbH and Nukleare Transportleistungen GmbH, which aroused public interest in 1987 when suspicion of irregularities in connection with the disposal of radioactive waste became known. It involved in particular the disposal of waste in Mol, Belgium. In addition, there were suspicions of the misappropriation of fissile material and the unauthorized export of this material to Libya or Pakistan.[25] This led

22 Verdict of the Cologne Municipal Court on April 30, 1992 – 583 Ls 121/91; Albright 2010: 67f.

23 Koppe/Koch1990: 103; decision and report of the 2nd inquiry commission in accordance with Art. 44 of the Constitution (*Grundgesetz*) – BT-Drs. 11/7800 of October 15, 1990: 265.

24 Verdict of the Stuttgart Higher Regional Court of October 16, 2008 - 4 – 3 StE 1/07.

25 Recommendation and report of the 2nd Commission of Inquiry, according to Article 44 of the German Constitution – BT-Drs. 11/7800 of October 15, 1990: 12; Remarks on pages 1087ff – The suspicion of pro-

to all parties represented in the Federal Parliament demanding the setting up of a commission of inquiry, and moving the appropriate motions in January 1988.[26] The commission began its work on January 22, 1988.[27] Not until significantly later – in January 1989 – was the commission's remit expanded so that it now also encompassed criminal investigations by several district attorneys of violations of the Foreign Trade and Payments Act (AWG) and the War Weapons Control Act (KWKG) through unauthorized exports as well as the criminal proceedings of the Hanau District Attorney against Rudolf Ortmayer, Peter Finke and Dr. Heinrich Weichselgartner.[28]

The criminal proceedings against Rudolf Ortmayer, Peter Finke and Dr. Heinrich Weichselgartner were triggered by a complaint in February 1988 by the company doctor of NTG, who had found out about the illegal activities of Ortmayer and did not wish to keep this to himself. For Ortmayer had been dismissed by the company owner shortly before for the embezzlement of funds, but not prosecuted because it was feared that the illegal business activities of Ortmayer would be discovered (*Der Spiegel* 1989, 1: 22ff; Koppe/Koch 1990: 106, 108). On November 30, 1988 a warrant for his arrest was issued by the Gelnhausen District Court (Koppe/Koch 1990: 109).

The verdict of the Hanau Regional Court had essentially the following content:[29]

Rudolf Ortmayer initially worked as a mechanical engineer for NUKEM and Reaktor-Brennelemente-Union (RBU) in Hanau, and was responsible there for the manufacture of nuclear fuel rods. In 1971 he switched to the NTG company in nearby Gelnhausen, and was initially production manager there and in 1974 was promoted to independent manager of Komplementär-GmbH (Koppe/Koch 1990: 107).

In 1981 he had contact with the Pakistani citizens Sulfikar Ahmad Butt and Dr. Nyamat Ali Javed of the PAEC. Ortmayer learned from his Pakistani acquaintances that Pakistan was in a difficult situation at that time in connection with further operation of the heavy-water moderated and cooled natural uranium fueled, horizontal pressure tube KANUPP I reactor supplied by Canada. It was true that Pakistan had become a member of the IAEA, but it had refused to sign the non-proliferation treaty and place all its nuclear technology plants under the supervision of the IAEA. In order to put pressure on Pakistan Canada had

liferation: "At the beginning of 1988 it was claimed in the media that weapons-grade material had been misappropriated in Mol and transported to Lübeck by Transnuklear." There it is alleged to have been hidden under coal on a freighter and delivered to Libya or Pakistan via Finland. This material was supposed to have been loaded aboard the ship in the private dock of Neue Metallwerke Lübeck GmbH, which is said to belong to the Gokal brothers, two Pakistanis also involved in arms trafficking. This scenario was investigated by the committee."

26 Loc. cit., p. 7 ff.

27 Loc. cit., p. 10 left column.

28 Loc. cit., p. 9 right column.

29 The presentation is based, partly verbatim, on the court opinion underlying the verdict of the Hanau Regional Court of October 29, 1990 – 6 Js 11608/88 KLs.

not delivered any more fuel rods to Pakistan since 1975. For this reason, Pakistan was attempting to procure these materials secretly. Ortmayer knew that this special situation could lead to profitable business for the NTG company and for him personally.

Export of zirconium alloy

As a result, in the period from 1983 to1986 there were 23 exports of a total of 26 tons of zirconium alloy material for the production of fuel rod cladding tubes. According to Item 0104 of the export list, the zirconium alloy required an export license because the alloy had a zirconium content of more than 50%. Ortmayer knew that authorization by the then Bundesamt für gewerbliche Wirtschaft (Federal Office for Commercial Economics) was required for export and that it was unlikely that he would receive this authorization. In a conversation with an employee of the BAW he learned that "No-one can rely on [receiving authorization]. But nobody checks the material to see whether it is stainless steel or zirconium." For this reason he did not even apply for authorization and declared the goods as stainless steel. In order to conceal the business relationship of NTG with Pakistan he worked through Peter Finke's PTB company. The graduate physicist Finke was initially an employee of the GSI Helmholtz Centre for Heavy Ion Research (German: GSI Helmholtzzentrum für Schwerionenforschung GmbH) in Darmstadt, Germany. In 1979 Ortmayer founded PTB together with Finke as a joint engineering office for which Finke worked about half-time from 1985, until he left GSI completely in 1987 to work exclusively for PTB (Koppe/Koch 1990: 146f). Business was then conducted in the following way: As manager of NTG, Ortmayer personally obtained the assignment, and PTB signed the contract with a sham Pakistani trading company behind which stood the PAEC. NTG purchased the material overseas and carried out the export to Pakistan under the name of PTB – Peter Finke signed all business-related and customs documents.

However, in accordance with § 154a StPO these findings were excluded from consideration by the Hanau District Court because, on the basis of a decision by the Darmstadt Administrative Court,[30] the decision by the Hesse Higher Administrative Court[31] on an appeal, and the decision on an appeal in another matter by the Federal Administrative Court[32] which at the time had not yet been announced, there was legal uncertainty about whether changes to the export list which had been decided before January 1, 1987 in a so-called "confidential circulation of documents" were legally binding.

30 Verdict of the Darmstadt Administrative Court of January 4, 1988 – III/1 E 652/86.

31 Verdict of the Hesse Higher Administrative Court of March 19, 1990 – 8 UE 811/88.

32 Verdict of the Federal Administrative Court of October 17, 1991 – 3 C 45.90. Within the framework of its decision on a constitutional objection the Federal Constitutional Court decided that the circulation of documents procedure was against the law and the 56th administrative directive on alterations to the AWV as well as the 53rd administrative directive on alterations to the export list were not carried out in a constitutional way. However, the infringement did not mean that these change directives were null and void, the Federal Constitutional Court continued.

Later exports led, nonetheless, to a conviction as this legal uncertainty no longer existed because the German government overturned the confidential circulation of documents procedure. The foreign trade regulations which came into force on January 1, 1987 as well as the export list related to the regulations were approved in a cabinet meeting on December 18, 1986.

On March 18, 1987 the bogus Pakistani PAEC company Margalla Enterprises ordered 3 tons of zirconium alloy tubes and 750 kg of zirconium sheeting from PTB. Placement of the order involved Pakistani diplomatic couriers.[33] The execution of the transactions took place in tried and true fashion; the tubes and sheeting were declared as stainless steel and Finke signed the papers.

Export of a vacuum induction furnace

In early 1985, representatives of the PAEC showed an interest in purchasing a furnace for smelting natural uranium. Ortmayer prepared a corresponding offer for a vacuum induction furnace designed specifically for smelting uranium, and received the order on February 19, 1986.

The sham PAEC company Pakistani Modern Technical Arts in Rawalpindi played the part of the customer. Ortmayer and Finke traveled to Pakistan to discuss construction details. As a result, it became clear to Ortmayer that the fuel rods to be produced using this furnace were not intended for the IAEA-supervised heavy-water reactor KANUPP I, because its nuclear fuel rods consisted of uranium dioxide pellets, but for an unknown reactor not under IAEA supervision. The vacuum induction furnace was completed by NTG partly by buying components and partly by constructing it itself. According to Item 0204 of the export list, export of the vacuum induction furnace required authorization because it had been designed specifically for manufacturing nuclear fuel rods. Ortmayer knew that the furnace required export authorization and that he would not receive authorization to export it. For this reason he did not submit an application for an export license and when exporting the smelting furnace to Pakistan declared it as "scientific equipment" on July 30, 1987.

Export of a rod-straightening machine

Although Ortmayer had presented the Pakistanis with a concept for a complete plant for producing uranium fuel rods consisting of a total of 25 components including the vacuum induction furnace (the so-called R line),[34] he now received an order for a further individual component – a straightening machine needed for straightening the cast uranium rods. However, this was needed to meet the requirements for straightening zirconium

33 It was also possible to prove the involvement of Pakistani diplomats in other criminal proceedings.

34 The account given by Koppe/Koch 1990 is different: 116f. According to them, Ortmayer sold and exported the entire R line.

alloy tube cladding they themselves manufactured. After NTG had received the order from the PAEC, this time through the sham "Directorate of Technical Procurement," through Peter Finke's contacts NTG turned to a German manufacturer which built the straightening machine. Pakistani engineers took delivery of the machine from NTG. According to Item 0204 of the export list, export of the rod-straightening machine required export license because it had been specifically designed for manufacturing nuclear fuel rods. Without any application for an export license, the machine, which required export license, was declared as "scientific goods" as part of being processed for export to Pakistan on December 16, 1987.

Export of a tritium handling system

In addition, Ortmayer sold and exported a tritium handling system and 8,000 curies[35] of highly purified tritium to his customers in Pakistan. Dr. Weichselgartner, who was also convicted, had a key role in these transactions. Dr. Weichselgartner was the longstanding head of the tritium laboratory at the Max Planck Institute for Plasma Physics in Garching nearby München, Germany. The institute works on the development of fusion reactor technology. Though very rare, trace amounts of tritium occur in nature and can be obtained from lithium 6 artificially in a breeder reactor. It is as an unwanted byproduct in heavy-water moderated natural uranium reactors – such as at the KANUPP I nuclear power plant in Karachi, Pakistan. Tritium can be used for civilian purposes in the production of self-illuminated fluorescent lamps and self-luminous paint. Militarily, the explosive force of bombs made from uranium or plutonium can be substantially increased with tritium that is more than 95% pure in combination with deuterium.

On May 8, 1984 S. A. Butt, who carried out the procurement transactions from the Pakistani Embassy in Paris from 1975 to 1985, contacted Ortmayer with the request to submit a quote for a plant for the recovery of tritium from heavy water as well as a quote for the delivery of 500 liters of highly purified tritium. Ortmayer contacted Dr. Weichselgartner, in whose laboratory a laboratory-scale tritium recovery plant was located. Dr. Weichselgartner notified him about the radiation intensity of 500 liters of tritium – 1.3 million curies – quoted a price – DM3.4 million – and possible sources of supply. He also provided documents about the tritium recovery plant of a Swiss manufacturer.

Because the PAEC could not decide whether they wanted to buy tritium or produce it from heavy water, discussions took place with the Pakistanis in April 1984. Dr. Javed declared in the presence of Ortmayer and Finke that a not particularly detailed quote for a tritium recovery plant was required so that a decision could be made either for a plant or for the purchase of tritium. From the quote provided by Ortmayer for a plant complex consisting of a tritium recovery plant, a post-purification plant to achieve 95% purity, a tritium handling plant and a cleaning system for plant air at the tritium handling plant,

35 Curie – a unit no longer used nowadays; replaced by the Becquerel; 1 Ci = 37 GBq.

the Pakistanis ultimately purchased only the tritium handling plant including the cleaning system for the plant air[36] at the facility. The plant was exported in individual parts declared as "technical equipment" (Koppe/Koch 1990: 132) and "technical parts" in 1986 and put into operation in Pakistan by Peter Finke.

Export of tritium

In October 1984, S. A. Butt initially did so verbally, and somewhat later the Pakistani cover organization Margalla Enterprises, placed an order with Ortmayer for the delivery of 8,000 curies (2.96e+14 becquerel) of tritium. In November 1984 Dr. Weichselgartner arranged a meeting between Ortmayer and representatives of the Swiss company R. Chemie, a manufacturer of tritium, who explained to Ortmayer that a purchase was only possible through their German business partner, company G. Dr. Weichselgartner made contact with this company which made an offer addressed to Dr. Weichselgartner for "8,000 curies of tritium, not under international supervision, 95% pure for DM11.80 per curie." Dr. Weichselgartner advised them that the actual order would be made by Peter Finke of IBS, who would also provide the exact delivery address. As a sole proprietor, Finke ran IBS-Industrieberatungsservice (as well as the PTB company) as a commercial operation. When Finke named Pakistan as the recipient to the G. company, the owner of the company contacted the BAW, which informed him that the export of tritium to all countries in the world required an export license. In the case of export to Pakistan, a declaration of the intended use would have to be provided by the recipient. The BAW did not mention that in the case of the export of tritium not only an export license in accordance with the Foreign Trade and Payments Act (AWG) had to be applied for but also authorization in accordance with the War Weapons Control Act, which was issued not by the BAW but by the BMWi. For tritium is on the War Weapons List (KWL), which is an appendix to the War Weapons Control Act (KWKG). Company G. notified Dr. Weichselgartner about the requirement for an export license and he in turn notified Ortmayer.

The individuals involved in carrying out the transaction acted in the following way:

Because they realized a license for Pakistan would probably not be issued by the BAW, they chose to pretend that the delivery of the tritium gas would be to a recipient in Hong Kong – company J. – because they were expecting to receive an export license from the BAW for a recipient in Hong Kong. The tritium containers were to be sent to this company in Hong Kong as though they were full, but in reality would be empty; at the same time, containers declared to be empty, but which in fact would be filled with tritium, were to be delivered to Pakistan.

36 For more detailed information about the tritium handling plant and purification system, see the descriptions in Koppe/Koch 1990: 130ff.

Initially, the company G. could only supply 5,000 curies. Company G. was told that the recipient of the tritium would be company J. in Hong Kong and a forged end-use declaration from company J. was provided. In June 1986 the BAW issued an export license for the export of the tritium to Hong Kong – for use in the "manufacture of self-luminous paints" – endorsed with the requirement that a customs certificate from the receiving country should be forwarded later. At NTG the shipping documents – invoice, packing list, shipping order – were then prepared under the company name "IBS," with the description of the goods entered as "5 pc storage tanks." The shipping company collected the tritium filled containers from the German company G. and the ones declared as empty and bound for Pakistan from NTG. The accompanying papers were switched around and both shipments sent to Frankfurt by air freight for customs clearance. The five containers filled with tritium left the Federal Republic on Flight PK 806 bound for Karachi. After the containers, which were in fact empty, had arrived in Hong Kong and cleared customs, the shipping company allowed NTG to recall them as shipped empty by mistake. Company G. received the confirmation of customs processing in Hong Kong for presentation to the BAW.

In March 1986 the second delivery of 3,000 curies of tritium to Pakistan took place in the same way.

Verdict of the Regional Court of Hanau

On account of the actions described above and others,

- Ortmayer was sentenced to five years in prison
- and Finke to a prison term of three years and nine months and
- Dr. Weichselgartner to a prison term of one year and one month, suspended on probation,

by the Hanau Regional Court on October 29, 1990. Dr. Weichselgartner submitted an appeal against the verdict which was decided by the Federal Supreme Court in a decision handed down on January 31, 1992[37]. The appeal was unsuccessful.

Holger Koppe/Egmont R. Koch also reported that NTG exported 130 tons of raw aluminum for the construction of gas ultracentrifuges – in 80x50 cm blocks – to Khan Research Laboratories (KRL), from which centrifuges – presumably the outer shells, the so-called recipients (also called casings or housings) – were constructed (Koppe/Koch 1990: 117). The verdict of the Hanau Regional Court does not contain any references to this. This may result from the fact that at the time of the export aluminum blocks were not included on the export list (AL) and Art. 4 of the EU Dual Use Regulations, according to which even unlisted goods could require an export license, did not yet exist.

37 Verdict of the Federal Supreme Court of January 31, 1992 – 2 StR 250/91 – published in ZfZ 1992, 184ff with comments by Ricke.

3.4 Criminal proceedings against Heinz Mebus/Martin S.

One of the most important procurers for the Pakistani atomic (weapons) program was the German engineer Heinz Mebus, a close friend of A. Q. Khan since their Berlin student days (Koch 1988: 229; Koppe/Koch 1990: 60). Even in the early 1980s there was already evidence of procurements for Pakistan by him and his company, the engineering office H. Mebus VDI in Erlangen – later the Mebus & S. Handelsgesellschaft mbH – in connection with unauthorized exports to Pakistan by Albrecht Migule form 1977 to April 1980 (see above). Mebus was substantially involved in the crimes of Albrecht Migules – export of complete plants for the production of uranium hexafluoride to Pakistan. Despite this there is no evidence that he has been the subject of investigations. The leads in German publications which later continuously appeared were not sufficient for a criminal investigation on suspicion of offenses against the AWG or the KWKG to be initiated (Koppe/Koch 1990: 67ff). Foreign trade audits and customs clearence of goods being shipped by Mebus also failed to produce information which would have justified a criminal investigation. It is the fault of the inadequate possibilities of both foreign trade and payment audits according to § 44 AWG and customs clearance measures according to § 46 AWG that serious infringements of the AWG or the KWKG are rarely detected during these checks. For instance, the foreign trade audits must rely on the company to provide all the required documents; the officer has no right to carry out searches. In the case of export clearance, the detection of unauthorized exports mostly fails because the customs official lacks technical knowledge.

In the spring of 1992 the Customs Criminological Office (ZKA) obtained the right to monitor telecommunications and mail when concrete evidence justifies the assumption that somebody is planning violations of substantial significance of the AWG or the KWKG[38] (§§ 39 ff AWG – since annulled and replaced by §§ 23a ff of the Customs Investigation Service Act – ZFdG).

After Mebus was again mentioned as a procurer for Pakistan's military nuclear program by foreign sources in 1992, on October 23, 1992 the ZKA lodged an application with the Cologne District Court to order surveillance of the mail and telephone calls of Heinz Mebus and his son-in-law, the managing director of the Mebus & S. Handelsgesellschaft mbH, Martin S.

The suspicion that unauthorized exports were being planned was very quickly confirmed. The surveillance also made it possible to identify and corroborate related offenses previously committed. Consequently, on April 8, 1993 the Nuremberg-Fürth District Attorney commenced a criminal action against Martin S. (Mebus had died on December

38 Law on Amendment of the AWG, the StGB and other Laws of February 28, 1992 – BGBl. I: 372ff; see Ricke 2011: 92ff on specific details of preventive telecommunication and mail surveillance.

6, 1992). Martin S. and an accomplice were sentenced by the Nuremberg-Fürth District Court to two years and to 10 months in prison respectively, suspended on probation.[39]

The following material is based to a considerable degree on the contents of the verdict:

The District Court started by stating "in order to procure the equipment required for the isotope separation plant (plant for uranium enrichment by means of gas ultracentrifuges) Dr. Khan or members of the KRL acting on his instructions, who participated in the organization of shipments declared as Civil Works Organisation – CWO, [approached] the engineer Heinz Mebus from approximately the end of the 1970s, or during the same general time period the accused Martin S., who on behalf of the companies they represented […] accepted the orders, had the goods manufactured and delivered them to the customer." The engineering firm Heinz Mebus was involved "exclusively with the delivery of industrial equipment and technical parts to Khan Research Laboratories […] in Rawalpindi, Pakistan or to the Civil Works Organisation, which was under the control of KRL […]."

Martin S. began working for his father-in-law's company in 1988, initially as a clerk, but, due to the serious illness of his father-in-law, starting in 1990 he was obligated to take over management of the company to a greater and greater extent. In January 1992 S. was appointed managing director of the newly founded Mebus und S. Handelsgesellschaft mbH, Baiersdorf. Because he was only fully responsible for exports carried out starting with his joining the company, the Nuremberg-Fürth District Court dropped the charges involving unauthorized exports pursuant to § 154 StPO dating from April 28, 1988 to December 8, 1991. The verdict thus did not involve the crimes of Heinz Mebus, which date back to the 1970s, but only those of his son-in-law, who however continued the business as his father-in-law would have done while employing his means and methods.

In the period from January 9, 1992 to March 31, 1993 S. exported technical equipment worth approximately DM 800,000 to CWO in Rawalpinde, Pakistan. In three cases, with an accomplice he exported electronic components and computer software worth approximately DM 265,000 to CWO. In all cases he neglected to apply for an export license from the Federal Office of Economics (BAW), although he knew that the goods were intended for the operation of a KRL nuclear technology plant and several parts in the delivery were specified in the export control list.

The court said the following concerning the modus operandi:

"In delivering the technical equipment and the electronic components Tradinor Inc., Zürich, which is a mailbox company under the control of the accused or Heinz Mebus, was used. All deliveries were invoiced to this company and – in part with substantial markups – invoicing subsequently submitted to CWO. In this process, the billing and sundry written communications of Tradinor were carried out in the offices of the Mebus

39 Verdict of the Nuremberg-Fürth District Court of March 13, 1997 – 12 KLs 152 Js 439/93.

und Serr Handelsgesellschaft or Ingenieurbüro Heinz Mebus, using billing forms, letterhead, stamps, etc., of Tradinor. Payments by CWO were made to Tradinor bank accounts in Switzerland.

In the freight documents and customs declarations in addition to CWO, bogus companies in Dubai, the United Arab Emirates were listed as supposed recipients in order to conceal the real recipients of the goods, KRL."

The most important business carried out by S. in the time period in question was the export of ring magnets. Ring magnets are basic components of every gas ultracentrifuge. The rotor in the recipient – the external visible cladding of a gas ultracentrifuge – rotates on a needle sharp point. In order to ensure that the rotor remains straight it is necessary to stabilize it at the upper end too. This is done contact-free using a magnetic bearing, the so-called ring magnet. The ring magnet must have certain exact dimensions and be made from a particular alloy.

On the basis of an order from KRL in August 1991, S. had 48 ring magnets manufactured as specimens for a larger delivery at a later time, and exported them. To conceal the destination and the recipient – KRL –, in the freight papers he listed the non-existent Technoglobe in Dubai as the intended recipient. Ingenieurbüro Mebus invoiced the ring magnets to Tradinor Zürich, which in turn billed the shipment to CWO in Swiss francs. CWO's payment was made to the account of the letterbox company Tradinor at a Swiss bank.

At the end of 1991 the KRL director responsible for purchasing technical equipment, Mohammad Farooq, ordered 9,508 of the ring magnets described above. S. had them manufactured at a magnet factory and exported them to CWO on February 12, 1992 without applying for the license needed for their export. Once again, Technoglobe of Dubai was listed as the recipient. Payment was carried out as follows: Mebus and S. GmbH billed the ring magnets to the firm Tradinor, Zürich, which for its part billed Technoglobe of Dubai for the goods, which then invoiced the magnets to CWO in Pakistan. Payment was made to the account of Tradinor, Zürich.

In June 1991, Dr. Atta, director of the Process Division of the KRL, ordered two process cooling plants from S. S. and Dr. Atta had previously been at the German manufacturer and had examined equipment for that purpose. S. placed an order with the German manufacturer but listed Tradinor, Zürich, as the customer, and produced a confirmation from Sitara Chemical Industries Ltd, Feisalabad, in which this company was identified as the final customer. In this document, use in chemical production was given as the intended use. Using these documents S. submitted an application to the Federal Office of Economics for the issue of a so-called negative certificate – referred to today as "advice on information from the list of goods". A clearance certificate was always issued by the BAW when the goods to be exported were not on the list. The clearance certificate was used for presentation to customs in order to eliminate possible doubt about the need for a license. Had the BAW known the true recipient (KLR) and the true intended use (use in the uranium enrichment plant), it would have demanded an application for an export license from S. which would then have been refused.

At the request of S., the plants were delivered directly to CWO by the German manufacturer. The manufacturer billed Tradinor, Zürich, approximately DM 367,000. Tradinor Zürich billed CWO DM 400,000, which was transferred to the Swiss account of Tradinor, Zürich.

In October 1992 Mohammad Farooq ordered 20 square meters of Viton sheeting. Viton sheeting is used as a sealing material for a gas ultracentrifuge plant, in this case the one of KRL, about which S was aware. He had the sheeting manufactured and delivered to CWO without submitting the required application for an export license. Mebus and S. billed Tradinor, Zürich for the sheeting. The sheeting was then billed to CWO in the name of Tradinor, Panama, which paid the invoiced amounts.

In April 1993 the business activities of the companies ended abruptly as a result of the opening of the criminal investigation, especially the searching of their premises. The extremely extensive investigation was completed in December 1994, and in January 1996 the Nuremberg-Fürth District Attorney pressed charges. The two offenders, S. and F., were convicted on March 13, 1997.

As a result of the criminal investigation the business activity of the companies came to a standstill. Business relations with Pakistan were broken off completely, and the companies involved in the Pakistan business dissolved.

3.5 Criminal proceedings against Ernst Piffl

Exports by Team Industries under its manager Ernst Piffl for the uranium enrichment plant of KRL in Kahuta took place at an early stage. *Der Spiegel* had already reported in its edition of November 12, 1979 (46: 202ff) about the delivery of 31 high-frequency inverters which Emerson Electric Industrial Controls in Swindon, UK exported to Rawalpindi, Pakistan via Team Industries, Leonberg for DM 2,154,000. The equipment was flown directly to Rawalpindi from London. At that time the Emerson company was also supplying the British uranium enrichment plant in Capenhurst with high-frequency inverters. In an uranium enrichment plant high-frequency converters are used to convert alternating current into direct current. Since at that time the transaction was a license-free transit trade transaction for Team Industries, no violation of the AWG was committed, meaning no criminal investigation could be instigated.[40]

Team Industries was repeatedly mentioned in the press after this as well (*Der Spiegel* 1989, 4: 24 and 1989, 8: 62ff), however, coverage was always in connection with the high-frequency converter business from 1979.

40 Due to the legal situation at that time there were also no criminal consequences for the British company Emerson – Weissman/Krosney 1981: 187f.

As is the case with Martin S., who carried on Heinz Mebus's business after his illness and death, Ernst Piffl is also a son-in-law of Heinz Mebus (Albright 2010: 47). He may have made contact with Dr. A. Q. Khan through him.

Through surveillance of the telecommunications of Team Industries, the Customs Criminological Office discovered that on October 14, 1993 Ernst Piffl, manager of Team Industries, tried to export gas ultracentrifuge components to Pakistan from Stuttgart Airport. The parts, which were declared as "prefabricated ballpoint pen casings" in the customs declaration were in reality so-called scoops, which are gas ultracentrifuge components. The goods were confiscated and an inquiry opened (*Der Spiegel* 1994, 50: 57).

The inquiry essentially led to the following result:[41]

Until October 1993 – confiscation of the scoops at Stuttgart Airport – through his company, Team Industries, Piffl had a business relationship with Khan Research Laboratories (KRL) in Kahuta, Pakistan via the Pakistani Embassy in Bonn. In this period he supplied on the one hand parts and equipment for the uranium enrichment plant in large quantities, on the other acceleration gauges and components for rocket propellants for the Pakistan Space and Upper Atmosphere Research Commission (SUPARCO), which were listed in the export control list part 1, section C, item 7A101 or in the export control list part 1, section A, item 0008, and thus required an export license, without applying for one. In addition, he exported armaments and weapons technology in large quantities to the Pakistan Ordnance Factories (POF) without authorization.

The most significant were the exports for the uranium enrichment plant. This involved the scoops already mentioned, ring magnets, and in addition so-called "axes" (see below) and a rotary swaging machine for bending the scoops.

In essence, the court came to the following conclusions regarding the function of the exported parts: A gas ultracentrifuge consists of a rotor which is located in a housing in which there is a vacuum so that at its high speed of rotation the rotor will not be made red hot by the air resistance that would otherwise exist. Because of the extremely high number of revolutions, the rotor is only anchored at its lower end by means of a special axis in a special bearing. The upper bearing consists of two ring-shaped magnets; they keep the rotor floating without contact so that it functions like a gyroscope. Uranium hexafluoride is fed into the rotor. Because of the difference in mass of the isotopes uranium-235 and uranium-238, which are contained in different quantities in the uranium hexafluoride, during the rotation differences in concentration occur at certain locations. At these locations the uranium-235 enriched uranium hexafluoride and the uranium-235 depleted uranium hexafluoride are removed by scoops. The scoops are thin tubes or preforms on which final machining and forming is done after installation in the centrifuge.

41 The presentation is based on the findings in the verdict of the Stuttgart District Court of July 18, 1998 – 11 KLs 181 Js 85721/93.

After the staff member of the Pakistani Embassy responsible for undercover procurement approached Piffl in March 1988 and inquired whether Piffl could supply scoops and axes a contract was signed on April 18, 1988 between Team Industries and the Pakistani Embassy for the supply of 5,000 each of "W spindles," "P spindles" and axes. What was meant by the term "spindles" was scoops, with "P" standing for "product" (enriched uranium) and "W" for "waste" (depleted material). The recipient was to be the "Directorate of Technical Procurement," although the real recipient was the KRL, as Piffl also knew. He knew, or at the least assumed, that the items would be used as gas ultracentrifuge components. He also knew that for this reason the goods required an export license and that a license would not have been granted if he had applied to the BAW for one.

As a result, in the period from July 1988 to February 5, 1989 he exported a total of approximately 10,000 "P" scoops and "W" scoops, the first shipment being a test shipment and involving only 10 "P" scoops and seven "W" scoops. After this trial shipment was approved by the KRL the remaining shipments followed successfully. Payment in the amount of DM 200,000 was completed through the Pakistani Embassy in Bonn.

On the basis of a new contract dated August 10, 1990 Piffl supplied – also after a trial shipment – a total of about 5,000 "P" and "W" scoops. A further contract dated December 9, 1991 involved the supply of approximately 11,200 scoops.

On April 3, 1992 Piffl made an offer to the Pakistani Embassy to supply a semi-automatic swaging machine for bending the scoops at a price of DM 300,000. The Pakistani Embassy forwarded the contract to Piffl. "Manufacture of ballpoint pen parts" was given as the intended use; the "Institute of Industrial Automation" was indicated as the recipient, who were known to Piffl to carry out procurement for the KRL. When the export officer of Team Industries inquired at the BAFA whether the export of the machine would be approved, the BAFA expressed concerns about the Pakistani recipient, the Institute of Industrial Automation. Piffl then entered the Pakistani ballpoint pen manufacturer Sayyed Engineers in the application for export approval. The Federal Office of Economics and Export Control (BAFA) then informed Team Industries that there were no concerns about the export of the machine to this recipient. On September 7, 1993 Piffl exported the machine to Pakistan.

In a contract signed on September 8, 1993 Piffl agreed to supply 8,000 scoops. The first partial delivery of 1,000 scoops to Pakistan was to be carried out on October 14/15, 1993 via Stuttgart Airport. However, the Stuttgart Airport customs office did not clear this shipment, instead demanding that the exporter submit a negative certificate issued by the BAFA (today: advice on the list of goods). The scoops were seized by customs pending final settlement of the matter. Piffl submitted altered drawings to the BAFA and the application forms referred to the scoops as "aluminum semi-finished products for the construction of ballpoint pen casings." At the same time, Piffl delivered an end-use certificate which supposedly came from Sayyed Engineers (Private) Ltd, the Pakistan-based ballpoint pen manufacturer in Lahore. In reality, Piffl had issued the end-use certificate himself and signed it using an invented name.

Because the real facts were known to the investigating agencies through telecommunication surveillance, the stratagem failed. The scoops were confiscated. Following the investigation, further shipments were blocked.

Piffl was sentenced by the Stuttgart District Court to a prison term totaling three years and nine months for offenses against the Foreign Trade and Payments Act and for other crimes, and was fined DM 432,000.

3.6 Criminal proceedings against executives of Company V.[42]

In the course of the investigation of executive T. of company O. on grounds of unauthorized export of aluminum tubes – intended for the manufacture of casings for gas ultracentrifuges – to North Korea, in May 2003, the company executive V. in P. was suspected of exporting goods to Pakistan without official authorization where such permission was compulsory. The Customs Investigation Office responsible in Stuttgart began an investigation and searched the offices of the company on June 16, 2003 after being granted a search warrant by the relevant local court. Suspicions of an offense were corroborated further by the order book found during the search as well as by the subsequent KOBRA research.[43] In May 2004 the Customs Investigation Office informed the relevant District Attorney's Office (Munich I). The district attorney obtained authorization from the relevant local court for telecommunications surveillance according to §§ 100a German Code of Criminal Procedure (StPO) as well as a search and seizure warrant, which was executed on November 24, 2004. V. was arrested on November 23, 2004.

The accused was charged on May 17, 2005 and sentenced by the First Munich District Court on November 24, 2005. The charges involving known violations of the War Weapons Control Act (KWKG) which were part of the overall crime were dropped in accordance with § 154 a (2) German Code of Criminal Procedure.[44]

In its verdict the District Court ruled that in the period from November 1999 to October 2004, the executive V. of company V. had infringed the Foreign Trade and Payments Act in 23 cases, two cases of which were only attempts because it was possible to stop these exports as a result of the investigation.

On April 25, 2000 V. had signed an agency agreement with a company located in Islamabad, on the basis of which the company in Pakistan was commissioned to obtain orders for company V. on a commission basis. By 2004, company V. had received over 300 inquiries from Pakistan for the supply of a wide variety of goods on the basis of this

42 *Süddeutsche Zeitung* of November 18, 2005: 9; FOCUS 2005: 39: 62.

43 KOBRA (export control) was the information processing system of the customs administration until August 1, 2006 when it was replaced by the ATLAS Ausfuhr electronic customs administration system.

44 Verdict of the First Munich District Court of November 24, 2005 – 6 KLs 115 Js 11042/04.

arrangement. Among the inquiries were 25 involving the supply of vacuum technology, a key technology for the construction of uranium enrichment plants. In addition, certain materials such as special steels and aluminum were requested which, because of their unique properties, could also be used in uranium enrichment.

It was in this way that numerous contracts were signed with Pakistani companies such as Victor Star Ltd., TechNet Corporation Ltd., Lodgeaction Ltd., Matrix Technical Services and A.H. Associates (FOCUS 2005, 39: 62), which serve as cover organizations for the Pakistan Atomic Energy Commission (PAEC) or the Khan Research Laboratories (KRL). The real recipients of the goods exported in this way were the PAEC and the KRL.

For instance, in 2001 company V. repeatedly exported spare parts for filament winding machines to Pakistan, in each case declaring them as "replacement parts for water sprinkler equipment" to customs. Among other applications, filament winding machines are used in the manufacture of rotors for gas ultracentrifuges or for the manufacture of missile casings, and – depending on how the filament winding machines can be used – require an export license. Despite being explicitly warned by the supplier about the possible need for an export license, V. did not apply for a license.

Following a Pakistani inquiry, V. purchased 100 kg of a certain carbon fiber from a German supplier. The German company pointed out that an export license was required. Carbon fibers are cited in Appendix 1 of the EU dual-use regulations as well as in part 1 of Appendix AL of the Foreign Trade and Payments Regulation, Item I C 210, and thus require an export license. Carbon fibers are processed on fiber winding machines to manufacture such items as rotors for gas ultracentrifuges or to manufacture missile components. Although V. knew about the requirement for an export license, he did not submit an application for an export license, instead shipping the carbon fibers from Munich to Pakistan by air freight in September 2002 while falsely declaring them as glass fibers and stating the goods were worth less than their real value.

In addition, V. exported spare parts for a mass spectrometer, special metal sheeting, various pumps with accessories and vacuum technology equipment without the required export license.

The First Munich District Court sentenced V. to seven years and three months in prison and refused to grant the company V. compensation in the amount of Euro 150,000.[45] Because both the convicted and the District Attorney resigned the right to appeal, the verdict came into force immediately. This is the highest prison sentence ever handed down by a German court for a proliferation offense. If this sentence is compared with the sentence given to Albrecht Migule (eight months in prison suspended on probation for an objectively far more serious crime), it is evident how much the attitude to proliferation offenses has changed in the meantime.

45 Verdict of the First Munich District Court of November 24, 2005 – 6 KLs 115 Js 11042/04.

4. Nuclear Tests in 1998

While the trial of Ernst Piffl was still taking place before the Stuttgart District Court between March 9 and July 20, 1998, first India on May 11 (*Der Spiegel* 1998, 21: 162ff) and then Pakistan on May 28 and 30, 1998 carried out nuclear testing.

Many years of preparation preceded Pakistan's tests. Initial, so-called cold tests – tests without fissile material – took place on March 11, 1983 under the leadership of Dr. Ishfaq Ahmed of the PAEC in tunnels in the Kirana Hills near Sarghoda. In March 1984, KRL conducted its own tests near Kahuta (Sublette 2002: 2). By 1981, the later site of the atomic tests had already been viewed and selected – the Chagai Hills in the Balochistan Province of western Pakistan. While KRL was responsible for the production of the necessary fissile material – uranium-235 – the PAEC worked on the production of the actual bomb, especially the detonator. Chinese scientists are said to have been helpful in this regard.[46]

In political terms, India's nuclear test on March 11, 1998 on the Pokhran test site created the ideal situation for Pakistan to start conducting its own tests. The Pakistanis were taken completely by surprise by India's nuclear test (*Der Spiegel* 1998, 21: 162ff). In several meetings of the Defence Committee of the Cabinet (DCC) under the leadership of the then Prime Minister Mohammad Nawaz Sharif the Pakistanis decided to conduct their own nuclear tests within fourteen days. Representatives of both the PAEC and KRL participated in the meetings, and the rivalry between the two institutes was once again evident: Both wanted to be given responsibility for the tests, and assured that they would be able to conduct the tests within 10 days. In the end, the PAEC won. A. Q. Khan obtained the concession that he could be present during final preparations for the test and at the test itself (Azam 2000: 5f).

The Pakistani scientist Dr. Samar Mubarak Mand was put in charge of the tests (Azam 2000: 6). The tests were scheduled for May 28, 1998 at 3:00 PM. In the early hours of May 28, 1998 Pakistan cut off automatic transmission of data from its seismographic stations to foreign countries, and the Pakistani armed forces were mobilized. At 2:30 PM a Pakistani army helicopter brought the observer team to the observation post, which was located 10 km from the test site. PAEC Chairman, Dr. Ishfaq Ahmed, KRL Director Dr. A. Q. Khan and four other KRL scientists were part of the observer team. At 3:16 PM, the explosions were set off. A short time after that the earth shook and the mountain was cloaked in a beige cloud of smoke (Azam 2000: 7f).

Pakistan conducted a further nuclear test on May 30, 1998 in Kharan, a flat desert valley 150 km south of the Ras Koh Hills. The explosive force is believed to have been sub-

46 Sublette 2002: 3: "In July 1984 the New York Times reported that US intelligence had learned that the previous year that China had supplied Pakistan with the design of an actual tested nuclear device – the design of China's fourth nuclear weapon tested in 1966 with a yield of 25 kt. That is said to be a low weight (200 kg class) solid-core bomb design."

stantially less, although it is not known whether one or two explosive charges were involved (Azam 2000: 8).

In a resolution of June 6, 1998 the UN Security Council unanimously condemned India and Pakistan for their atomic tests[47] and called upon both states to conduct no further test, to close down their atomic weapons programs immediately and to become members of the non-proliferation treaty.

On March 12, 1999 Dr. A. Q. Khan was (again) awarded [48] the highest Pakistani civilian order for his services: "Nishan-e-Imtiaz" (Order of Excellence).

5. Closing Remarks

Looking back at the time from the mid-1970s to the early 1990s, the situation is best summarized in the words of Holger Koppe and Egmont R. Koch, who in 1990 wrote in their book "Booming Deals – Deadly Weapons for the Third World": "If you take NTG, Leybold, Team and Messrs. Migule and Mebus together, Pakistan was able to fulfill nearly all its wishes from the mid-1970s to 1988 with West German help, from uranium hexafluoride production to centrifuge enrichment technology, through to fuel rod production and tritium technology, including the necessary computer technology and other equipment for building bombs. The companies and individuals named are examples only. Many, many others played an active role in the export business, partly below the approval threshold, and partly by exploiting gray areas in German foreign trade law. […] Because India also diligently used West German suppliers for their nuclear armament program, the arms race on the subcontinent will probably continue in the future." (Koppe/Koch 1990: 151, 153).

Indirectly, these exports have also contributed to Pakistan itself being able to act as a proliferator, as the second criminal case against Gotthard Lerch (see above) and other proceedings abroad against accomplices of Abdul Qadeer Khan have shown.

In the subsequent period (1990 to 2000) a rethinking process has taken place in Germany, and legal and practical measures have been taken to effectively address proliferation. Only as a result of this have there been notable investigative successes and prevention of unauthorized exports since 1990. But these – in particular German national – measures are not nearly enough. In terms of "combating proliferation" little has been seen or heard in recent decades from other highly industrialized European nations such as the UK and France.

47 Resolution 1172 (1998) of the UN Security Council of June 6, 1998 – www.un.org.

48 On the first occasion in 1989 he received this order at the level of "Hilal-i-Imtiaz" – Defence Journal 1990/12: 12, then the highest level, "Nishan-i-Imtiaz," for the first time on August 14, 1996.

But in any case there must be no facilitation of arms deliveries, be it delivery to EU member states or export to third-world countries. On the contrary, the federal government should insist that other EU member states too reach the standards attained in Germany.

So what should be done to deal more effectively with the proliferation of weapons of mass destruction than in the past?

As a highly industrialized and extremely export-oriented country, the Federal Republic of Germany plays a prominent role in the fight against proliferation. But for some years, German export controls have been focused on only one area: the nuclear armament of Iran. This topic is certainly of paramount importance because with the possession of nuclear weapons by Iran, the balance of power in the Near East and Middle East will change, and since Iran is also already in possession of long-range missiles today, the threat not only to Israel but also to Europe is growing. Efforts to procure weapons of mass destruction involve not only nuclear weapons, but also chemical and biological weapons; procurements are being carried out not only by Iran but also by other states, and still by Pakistan (Stricker 2011). Even countries that were previously not in focus, such as Myanmar, have been suspected of pursuing nuclear weapons in the last few years (Selth 2007). This danger could be averted through the hopefully ongoing process of liberalization in Myanmar. But at present, you cannot be sure. Taiwan also represents a danger, although at least publicly there is no evidence whatsoever of the procurement of weapons of mass destruction. South America should also come into the picture, and here in particular Brazil and Argentina, who were the focus of German export controls years ago. However, not only the procuring countries are of interest, but also the conduit countries. Who would have thought a few years ago that Malaysia could be involved in obtaining nuclear technology, as the procurement network of A. Q. Khan has shown?

Although the Customs Administration of the Federal Republic of Germany employs rather large numbers of staff in comparison to other European countries, this extensive task can only be mastered if the countries in which procurement efforts originate employ more and better-trained staff who are able to evaluate the enormous amount of data available for dealing with individual areas of proliferation (ABC weapons, missiles).

The existing export control instruments should be maintained and developed further. Thus the monitoring of telecommunications, correspondence and postal traffic[49] in Germany has proved its value and is indispensable as a source of information for preventive and repressive measures. The number of foreign trade audits has again been falling for years. Considering the fact that tens of thousands of German companies take part in foreign trade, the 1,000 audits carried out per year is far too low.

49 For details see Ricke 2011: 192ff.

One must always break new ground. So in certain specific cases post-shipment control is a sensible measure.[50] The federal government should therefore review its opposing stance.

Preventive seizure of goods has existed in Germany since 2007.[51] The Customs Investigation Service should make use of it as often as possible. For prevention is more important than the repressive measures of criminal proceedings. An amendment to § 32b Customs Investigation Service Act (ZFdG) would be desirable, according to which preventive seizure is also possible, even if the danger is not currently present.

However the crucial factor for effectively combating proliferation in all areas of procurement of weapons of mass destruction is situated at the European level. Germany has made great progress in combating proliferation from the 1970s until today, and at times even took a pioneering role with its national regulations on export control. But Germany got stuck halfway. For the fight against proliferation is a task that Europe in essence must still take on, not only through the enactment of legislation, such as the enactment of the repeatedly amended dual-use goods regulation, however important this piece of legislation may be. It is true that in practice progress has been made; one need only consider the now EU-wide IT-supported clearance system for importing and exporting goods (in Germany especially ATLAS export), which – unlike in the past – makes it possible to determine when and where an item has left EU territory. The reason for this EU-wide system is not primarily the fight against proliferation, however, but rather the facilitation of import and export clearance. In addition, attention is being paid to risk analysis, not only at national but also at the EU level, though not primarily – if at all – from the point of view of preventing proliferation, but rather from the point of view of the war against terror (security risk analysis). However proliferation and terrorism are fundamentally different with regard to they are justified or how they manifest themselves.

The cooperation among European customs administrations, which works outstandingly well in other areas such as fighting drug trafficking, must be improved even more in the area of combating proliferation. In the past – apart from the US – only the Netherlands and the UK were interested in exchanging information. However, other countries such as France and Italy are also highly industrialized countries which pose a risk in terms of proliferation.

At a European level an office – comparable to OLAF[52] – must be established to gather information regarding "proliferation" in Europe (if not worldwide), to evaluate it and

50 End-use inspections as they are intended – in other words checking sites in the destination country – are rejected by the German government, responded Cornelia Pieper, Minister of State in the FO, during Question Time in the Bundestag on December 14, 2011 – plenary proceedings 17/148, 17737. The parliamentary party Alliance '90/The Greens is calling for such end-use inspections – resolution of parliamentary party Alliance '90/The Greens of February 28, 2012 www.gruene-bundestag.de/cms/beschluesse/dokbin/404/404476.ruestungsexporte.pdf.

51 For details see Ricke 2011: 316ff.

52 OLAF – Office Europeen de Lutte Anti-Fraude – European Anti-fraud Office.

then to coordinate the work of the various authorities in the EU Member States in the fight against proliferation ("Office for Combating Proliferation"). The customs administrations of the EU Member States should provide the necessary personnel because it is the task of customs administrations to control the import and export of goods. Prevention and not repression must absolutely be at the forefront, because once it has come to criminal unauthorized export, damage has occurred that cannot be made good through even the most severe punishment. Therefore the fight against proliferation cannot be an – additional – task for Europol.

Assessment of the implementation

As regards the implementation of these proposals, one can only be skeptical. Currently there is no evidence that the most important requirement for an effective fight against proliferation – the creation of a central European authority – will be considered by the Commission or by the European Parliament. At a national level, this requirement has recently been formulated by Alliance '90/The Greens in their party resolution of February 28, 2012.[53] The demand for control at the EU level includes also, and especially, legal exports. This is because proliferation occurs not only through illegal exports, but also to a not inconsiderable degree through legal exports or exports in the gray area. The focus here should not be on the area of weapons of mass destruction, but on the export of conventional weapons of war instead.

53 Alliance '90/The Greens, party decision of February 28, 2012 – arms export control – securing peace and protecting human rights – a new arms export law, 10 – www.gruene-bundestag.de/cms/beschluesse/dokbin/ 404/404476.ruestungsexporte.pdf (November 28, 2012).

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List of Abbreviations

AA	Foreign Office of the Federal Republic of Germany or German Foreign Office (Auswärtiges Amt)
WMD	Weapons of Mass Destruction
AG	German Municipal Court (Amtsgericht)
AL	Export control list or export list (Ausfuhrliste)
ATLAS Ausfuhr	Electronic customs administration system (as of 2006)
AWG	Foreign Trade and Payments Act (AWG)
AWV	Foreign Trade and Payments Regulation (Außenwirtschaftsverordnung)
BAFA	Until December 31, 2000, Federal Office of Export (Bundesausfuhramt, BAFA); subsequently the Federal Office of Economics and Export Control (Bundesamt für Wirtschaft und Ausfuhrkontrolle)
BAW	Federal Office for Commercial Economics (Bundesamt für (gewerbliche) Wirtschaft)
BGH	Federal Supreme Court (Bundesgrichtshof)
BGBl.	Federal Law Gazette (Bundesgesetzblatt)
BMF	Federal Ministry of Finance (Bundesministerium der Finanzen)
BMFT	Federal Ministry of Education and Research (Bundesministerium für Bildung und Forschung)
BMWi	Federal Ministry of Economics and Technology (Bundesministerium für Wirtschaft und Technologie)
BND	Federal Intelligence Service (Bundesnachrichtendienst)
BR-Drs.	German Bundesrat document (Bundesratsdrucksache)
BT-Drs.	Bundestag document part I or part II
BVD	Binnenlands Veiligheidsdienst – the Domestic Intelligence Service in the Netherlands until 2002
BVerfG	Federal Constitutional Court (Bundesverfassungsgericht)
BVerwG	Federal Administrative Court (Bundesverwaltungsgericht)
CHASNUPP	Chasma Nuclear Power Plant
CWO	Civil Works Organisation
DCC	Defence Committee of the Cabinet
DV	Data Processing (Datenverarbeitung)
EC	European Community
ERL	Engineering Research Laboratories (later: KRL)
EU	European Union
FDO	Fysisch Dynamisch Onderzoekslaboratorium Technische Onderzoeken B.V.
GfK	Gesellschaft für Kernforschung mbH

GSI	Gesellschaft für Schwerionenforschung
HEU	Highly Enriched Uranium
IAEA	International Atomic Energy Agency
IBS	IBS-Industrieberatungs-Service (company of Peter Finke)
KANUPP	Karachi Nuclear Power Plant
KfK	Kernforschungszentrum Karlsruhe
KOBRA	Kontrolle bei der Ausfuhr (IT system of Federal Customs Administration from 1991 to 2006)
KRL	Khan Research Laboratories
KWKG	War Weapons Control Act (Kriegswaffenkontrollgesetz)
KWL	War Weapons List (appendix to the War Weapons Control Act – KWKG)
LEU	Low Enriched Uranium
MWB	Metallwerke Buchs
NTG	Neue Technologien GmbH & Co KG (company of Rudolf Ortmayer)
PAEC	Pakistan Atomic Energy Agency
PARR	Pakistan Atomic Research Reactor
PINSTECH	Pakistan Institute for Nuclear Sciences and Technology
PTB	Physikalisch-Technische Beratung
RBU	Reaktor-Brennelement-Union
SGN	Saint-Gobain Techniques Nouvelles
DA	public prosecutor/district attorney
StGB	German Criminal Code (Strafgesetzbuch)
StPO	German Code of Criminal Procedure (Strafprozessordnung)
UN	United Nations
UNC	Ultra-Centrifuge Nederland N.V.
URENCO	Uranium Enrichment Company
UWG	Act Against Unfair Competition
VG	Administrative court (Verwaltungsgericht)
VGH	Higher Administrative Court (Verwaltungsgerichtshof)
UN	United Nations
ZFA	Customs Investigation Office (Zollfahndungsamt)
ZFdG	Customs Investigation Service Act (Zollfahndungsdienstgesetz)
ZfZ	Zeitschrift für Zölle und Verbrauchsteuern
ZKA	Customs Criminological Office (Zollkriminalamt, as of 1992) – Headquarters of the Custom Investigation Service